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Original Research

Is vitamın D level related to bilateral lateral epicondylitis?

Bilateral lateral epicondylitis and vitamin D

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Abstract
Aim: This study aimed to examine the relationship between unilateral lateral epicondylitis (ULE), bilateral lateral epicondylitis (BLE), and vitamin D levels.
Material and Methods: Between January 2016 and January 2021, 112 ULE patients (67 men, 45 women, mean age 45.55±10.75 years), 90 BLE patients (47 men, 43 women, mean age 44.93±9.76 years), and 134 patients determined as the control group (47 men, 43 women, mean age 44.93±9.76 years) were included in the study. The three groups were compared in terms of vitamin D levels.
Results: The mean vitamin D level was 24.87±8.45 ng/ml in the control group, 16.67±8.08 ng/ml in the ULE group, and 12.2±5.71ng/ml in the BLE group. There was a significant difference in vitamin D levels between the control and ULE group, the control and BLE group, and the ULE and BLE group ($p<0.001$, $p<0.001$, $p=0.014$, respectively).
Discussion: Vitamin D levels of patients with bilateral lateral epicondylitis were significantly lower than those with unilateral lateral epicondylitis. This study shows that low vitamin D may be one of the etiological factors of lateral epicondylitis and may cause bilateral lateral epicondylitis at lower values.

Keywords
Vitamin D, Lateral Epicondylitis, ECRB, Elbow Pain

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Introduction

Lateral epicondylitis (LE) is a common musculoskeletal disorder with a prevalence of approximately 30% in tennis players and 1% in the general population [1]. The etiology of LE does not appear to be related to sex and ethnicity, and has not been clearly established. Still, it is assumed that the main etiological factors are repetitive overuse and structurally abnormal collagen production [2,3].

In over 95% of LE cases, the extensor carpi radialis brevis (ECRB) is affected [4]. In the study by Ando et al., they suggested that the attachment area of the ERCB tendon to the lateral epicondyle of the humerus is 13 times smaller than the attachment area of the extensor carpi radialis longus (ECRL) tendon; therefore, the ECRB tendon is more fragile [5]. Bunata et al., on the other hand, associated LE with friction between the ERCB tendon and the humeroradial joint [6].

Vitamin D has anti-proliferative, pro-differentiative, and pro-apoptotic functions and is produced in the skin with exposure to sunlight [7]. In the last decade, the role of vitamin D in balancing the health of the human body's immune system, reproductive system, and musculoskeletal system has come to the fore [8]. In addition, vitamin D deficiency has been associated with diabetes mellitus, cancers, cardiovascular diseases, and cognitive disorders [8,9]. Additionally, experimental studies show that vitamin D protects bones, muscles, and tendons [10]. In the same study, it was also shown that there is a vitamin D receptor in tenocytes. A recent study showed that vitamin D levels in unilateral LE patients were significantly lower than in the control group [11].

In this study, we hypothesized that there may be a relationship between bilateral LE (BLE) and vitamin D levels. This study aimed to examine the relationship between BLE and vitamin D levels.

Material and Methods

This single-center, retrospective study was conducted between January 2016 and January 2021 in the Department of Orthopedics and Traumatology Necmettin Erbakan University Meram Faculty of Medicine. Among the 527 patients who applied to our clinic with lateral elbow pain, 112 ULE (67 men, 45 women, mean age 45.55±10.75 years, range:18-60) and 90 BLE (47 men, 43 women, mean age 44.93±9.76 years, range:18-60) patients who met the inclusion criteria were included in the study. Inclusion criteria were age 18-60 years and a diagnosis of LE based on history and physical examination. The point of maximum tenderness on examination is usually above the lateral epicondyle or 1-2 cm to its distal [12]. When the ERCB tendon is palpated, pain occurs over the tendon, increased with wrist extension and forearm pronation [12]. Additionally, there should be no numbness or tingling in the examined extremity [12]. Exclusion criteria were previous trauma, history of upper extremity surgery, arthrosis, endocrinological diseases related to calcium parathormone metabolism, malignancy, rheumatological diseases, infection, and kidney diseases. In the same period, out of 681 patients (70 men, 64 women, mean age 40.48±11.74 years, range: 18-60) who applied to our clinic due to minor soft tissue trauma and had their vitamin D levels checked, 134 patients with no upper extremity complaints, no history of fracture-dislocation, no muscle and tendon damage, no inflammatory and degenerative orthopedic disease, no history of long-term immobilization, or any specific tendinitis who met the study inclusion criteria were determined as control group.

There is no universally accepted classification of vitamin D deficiency and insufficiency. In our study, Vit D ≥ 30 ng/mL was considered adequate, 20-29.9 ng/mL insufficient, and less than 20 ng/mL deficient [9,13].

Statistical Methods

Statistical analysis was performed using the IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were presented as mean ± standard deviation (SD), minimum and maximum (min-max), number, and frequency. Kruskal-Wallis, One-Way ANOVA, Mann-Whitney U, and t-tests were used to compare independent variables. A p-value of <0.05 was considered statistically significant. Post-hoc power calculations were performed using the G*Power software (version 3.1.9.4, Heinrich Heine University, Düsseldorf), taking alpha error as 0.05 with a two-tailed significance.

Ethical Approval

Ethical approval was obtained from the Necmettin Erbakan University Ethics Committee" (IRB number: 2022/3672).

Results

The demographic information of the patients is summarized in Table 1. When ULE, BLE, and control groups were compared in terms of age and sex, there was no significant difference (p=0.14, p=0.56, respectively). The mean vitamin D level was 24.87±8.45 ng/ml in the control group (range: 10.9-49.0), 16.67 ± 8.08 ng/ml in the ULE group (range: 8.3-39.6), and 12.2±5.71 ng/ml in the BLE group (range: 4.2-27.3) (Table 2). When the control group and ULE were compared, the vitamin D level of the ULE group was significantly lower than the control group (p<0.001) (power: 0.99, effect size d: 0.94). When the control group and BLE were compared, the vitamin D level of the BLE group was significantly lower than the control group (p<0.001) (power: 0.99 effect size d: 1.42). When ULE and BLE were compared, the vitamin D level of the BLE group was significantly lower than the ULE group (p=0.014) (power: 0.95 effect size d:

Table 1. Demographic characteristics of the patients.

	ULE Group	BLE Group	Control Group
Number of patients (n)	112	90	132
Age (mean±SD)	45.55±10.75	44.93±9.76	40.48±11.74
Range: min-max	18-60	18-60	18-60
Sex (M/F)	67/45	47/43	70/64
Side (R/L)	59/53		

ULE: Unilateral lateral epicondylitis, BLE: Bilateral lateral epicondylitis

Table 2. Vitamin D values and ranges of the groups.

	ULE Group	BLE Group	Control Group
Level of vitamin D ng/ml mean±SD (min-max)	16.67±8.08 (8.3-39.6)	12.2±5.71 (4.2-27.3)	24.87±8.45 (10.9-49.0)
Vitamin D deficiency (0-19.9 ng/ml)	82 (73.2%)	79 (87.7%)	58 (43.9%)
Vitamin D insufficiency (20-29.9 ng/ml)	19 (16.9%)	7 (7.8%)	41 (31.1%)
Normal (>30 ng/ml)	11(9.9%)	4 (4.5%)	33 (25.0%)

Table 3. Subgroup comparisons.

Group compared	p-value
ULE- Control group	<0.001
BLE – Control group	<0.001
ULE - BLE	0.014

0.5) (Tables 2 and 3).

Discussion

The most important finding of this study is that the vitamin D levels of the patients with ULE and BLE were significantly lower than the control group, but the vitamin D levels were significantly lower in the patients with BLE compared to those with ULE. To our knowledge, this is the first study to examine BLE and ULE patient groups regarding vitamin D.

The main factor determining the structural mechanical properties of tendons is the amount and quality of type-1 collagen that forms the extracellular matrix [14]. The cells responsible for the synthesis of type-1 collagen are tenoblasts, while cells regulating type-1 collagen and other extracellular matrix-related proteins and type-1 collagen relationships and maintain their structural integrity are tenocytes [15]. In the experimental histological study conducted by Min et al., type-1 collagen gene expression decreased in tenocytes suppressed with dexamethasone, and returned to normal when exposed to 1-alpha hydroxylase and vitamin D. They showed that vitamin D has protective effects on tendons as well as bones and muscles in tenocyte cultures [10]. A significant relationship was previously established between ULE and low vitamin D [11]. The decrease in the protective effect of vitamin D in deficient patients may predispose to tendinopathy. In this study, the BLE group having significantly lower vitamin D levels than the ULE group supports that vitamin D has a protective effect on the tendons. It also indicates that vitamin D deficiency may be one of the factors involved in the etiology of lateral epicondylitis.

Vitamin D deficiency is a systemic problem, and may cause tendinitis in many regions, including the ECRB tendon. However, anatomical disadvantages that distinguish the ECRB tendon from other tendons and may cause tendinitis susceptibility have been reported. These are the ECRB tendon being longer than other tendons in the lateral elbow compartment, the smaller attachment site in the lateral humeral epicondyle than other tendons, and the friction between it and the humeroradial joint during elbow movements. However, none of these mechanical causes alone can explain the etiology of LE [5,6]. According to the data we obtained, vitamin D deficiency alone cannot explain the etiology of LE. However, vitamin D was significantly lower in the BLE group than in the ULE group, which supports that one of the multifactorial LE etiological factors may be vitamin D deficiency.

Park et al. investigated whether there is a relationship between LE and sex, dominant side, waist circumference, smoking, alcohol use, manual labor, diabetes mellitus, hypertension, hyperthyroidism, hypothyroidism, metabolic syndrome, ipsilateral rotator cuff rupture, ipsilateral carpal tunnel syndrome, cholesterol level, triglyceride level, LDL, HDL, dyslipidemia, hemoglobin A1c, and CRP in their study on 937 participants and 245 patients with LE in at least one elbow [16]. They found a significant relationship between LE and female sex, dominant side, manual labor, and ipsilateral rotator cuff rupture. Despite examining detailed parameters, no grouping of LE patients in terms of ULE or BLE has been made, and there was no vitamin D among the investigated parameters. While no significant difference was found regarding sex in our study, Park et al. significantly associated female sex with LE. In this respect, the two studies do not support each other. Although Park et al. provided a lot of useful information in their study, they did not compare BLE and ULE.

Limitation

Some limitations of this study are as follows: The exclusion criteria were wide to evaluate the effect of vitamin D on LE without being affected by other confounding factors, and therefore the small number of patients is a limitation of our study. Other limitations include not knowing the duration of the patient's complaints and not including occupation as a variable.

Conclusion

Vitamin D levels of patients with bilateral lateral epicondylitis were significantly lower than those with unilateral lateral epicondylitis. This study shows that low vitamin D levels may be one of the etiological factors of lateral epicondylitis and may cause bilateral lateral epicondylitis at lower levels.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

The authors declare no conflict of interest.

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